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THE
JOURNAL
OF THE
INSTITUTE OF ACTUARIES
(WITH WHICH IS INCORPORATED
THE ASSURANCE MAGAZINE).



INDEX

TO

THE FIRST FORTY VOLUMES.

LONDON:
CHARLES AND EDWIN LAYTON,
56, FARRINGDON STREET, E.C.

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LONDON :

PRINTED BY CHARLES AND EDWIN LAYTON,

56, FARRINGDON STREET.

INTRODUCTION.

THE 40th volume of the *Journal of the Institute of Actuaries* was completed by the publication of the number dated October 1906. A Combined Index had been prepared on completion of each previous set of ten volumes, as follows: (a) an Index to the First Ten Volumes, published in 1864; (b) an Index to the First Twenty Volumes, compiled by Dr. T. B. SPRAGUE as Editor, and published in 1883; (c) an Index to Volumes XXI to XXX, compiled by Mr. G. H. RYAN as Editor, and published in 1896. Having regard to the great practical inconvenience attending the reference to two, or more, Combined Indexes, and also to the fact that the Index to the First Twenty Volumes had for some years been out of print, the Council of the Institute authorized the present Editor to prepare for publication a Combined Index to the whole contents of the First Forty Volumes.

The labour of compilation has been considerable, but has been materially lightened by the fact that a complete Card Index had been prepared, under the authority of the Council, of the contents of the *Journal*, for reference by Members in the Hall of the Institute. This Card Index included the whole of the entries in the published Indexes to the First Twenty Volumes, and to Volumes XXI to XXX; and, in addition, a complete Index to the contents of each later number, up to the last current issue. The principles and methods followed in the published Index to Volumes XXI to XXX, which also formed the basis of the Card Index to later volumes, were somewhat more extended in scope than those followed in the Combined Indexes to earlier volumes,

more particularly as regards the inclusion of incidental references, in Papers, and Discussions thereon, to subjects not directly associated with or suggested by the title of such Papers. It was therefore decided that the whole contents of the First Twenty Volumes should be carefully read through, and entries made, in respect of such further items and topics as appeared to fall within the more extended scope of the combined Index to the later volumes. The result of this revision was a considerable extension of the Card Index, so far as the First Twenty Volumes were concerned; and it is hoped that a fairly uniform standard has thus been maintained, throughout the Index to the Forty volumes, and that the value and usefulness of the whole Index have thus been increased.

The Card Index, thus extended and revised, was copied out for the printer, and an independent and detailed examination of the proof-sheets was then made, especially as to secondary or subsidiary cross-references, which have been freely interpolated, wherever their insertion appeared to be necessary, or likely to increase the practical utility of the Index.

As the general scheme of the present Index closely accords with that on which the Index to Volumes XXI to XXX was prepared, and with which students and readers of the *Journal* are already familiar, it is not necessary to set out in detail the principles followed in the present compilation, but it will be sufficient to summarize the leading points, and to refer to some natural developments made in the present Index.

The main entries, whether relating to Authors or Subjects, are throughout printed, under a single alphabetical arrangement, in heavy (clarendon) capitals; whilst the smaller heavy type ("lower case" clarendon) is reserved mainly (*a*) under each author's name, for his principal contributions, usually by their full titles; (*b*) under each principal subject, for the names of authors furnishing leading contributions thereon; (*c*) under the main headings of subjects of great generality, such as Annuities, Colonial Intelligence, Foreign

Intelligence, Graduation, Institute of Actuaries, Original Tables, &c., for subsidiary headings, arranged alphabetically. Under the main reference to each Author, the whole of his contributions have been specified in chronological order, that is, according to successive volume and page; but later references to a subject already treated, whether by the author, or by way of comment or discussion by others, are appended, in ordinary type, to the first entry on the subject. Minor contributions are entered, both under Authors and Subjects, in ordinary type, as are subsidiary and cross references to subjects, under various headings. In respect of particular subjects, the main titles of which are printed in large, or small, clarendon type, the detailed entries are made in ordinary type, in chronological order; but, as in the case of entries under Authors, subsequent references are appended to the original entry.

Certain important subjects have, in the present Index, been somewhat more fully differentiated than in previous compilations. Thus, the entries under "Acts of Parliament" have been discriminated according to whether (1) the full text of the Act, (2) the text of certain sections, or (3) references only, are included; the items in each of these three divisions being placed in order of volume and page. The headings "British Offices' Experience" and "British Offices' Life Tables" appear for the first time in the Combined Index, and the entries have been made as inclusive as possible. Under the heading "Graduation", a full list of the Mortality Tables graduated is included, in alphabetical order. The classification of the items indexed under "Institute of Actuaries" has been considerably extended, as also of those under "Legislation" and "Marriage." The important subject of "Mortality" has been indexed in four divisions, and the individual references have been carefully analyzed, and subsidiary references freely inserted. The entries under "Original Tables" have involved much careful thought, and the selection and discrimination of appropriate items has not been an easy task, as the great majority of the contributions to the *Journal* are accompanied

by Tables, more or less of an original character. The plan finally adopted was to include, under the heading of "Original Tables", all Tables, specified in two divisions, under "Author" and "Subject", which seemed clearly to fall under this title, and appeared likely to be referred to by, or to be useful to, the student or actuary. The entries under the heading of "Premiums" have been extended, and further differentiated; and a new heading "Premium Rates, Tables of" has been introduced. The entries under "Reviews" are arranged in order of volume and page, according to the name of the author of the book reviewed; the name of the reviewer, where known, being also added. "Translations" include all contributions specified as such, with the name of the translator, where announced. The entries under the important heading "Valuation of Life Policies" have been arranged in three divisions, and the individual entries in each division have been carefully scrutinized.

Under the heading "Bonus (or Investigation) Reports", there have been set out the Valuation Reports of Companies, Funds, &c., included in Volumes XIV to XXIII of the *Journal*, but mostly discontinued after the passing of the Life Assurance Companies Act, 1870. The Annual Reports of British, Colonial, Indian and Foreign Companies, &c., which appeared only in the first five volumes of the *Assurance Magazine and Journal of the Institute of Actuaries*, have, however, been omitted from the present compilation. These Reports relate exclusively to the years 1848 to 1855, and are in respect of Companies, the majority of which have long ceased to have a separate existence. It is thought that such references can only have an historical interest, and the student who desires, for this or any other purpose, to peruse these ancient records, is referred to the heading "Reports of Companies" on pages 125 to 130 of the Index to the First Ten Volumes, or on pages 62 to 65 of the Index to the First Twenty Volumes; or to the Card Index, in which the full record of these items has been retained. The entries under the headings "Cattle Insurance", "Fire Insurance", "Hail

Insurance", and "Marine Insurance", contained in the earlier volumes of the *Journal*, have also been omitted from the present Index.

The Editor desires to express his deep sense of indebtedness to members of the Council, and others, who have kindly devoted much time and labour to the scrutiny and revision of proof-sheets of the Index, and made valuable suggestions as to additions or corrections, which have been given effect to, in all cases where they appeared to be consistent with the general scheme of the Index. The best thanks of the profession are also due to Mr. GEORGE GREEN, M.A., F.I.A., and Mr. S. H. JARVIS (Assistant Secretary of the Institute of Actuaries), who were appointed by the Library Committee, with the approval of the Council, to read through and scrutinize in detail the contents of the First Twenty Volumes of the *Journal*, so as to bring the Combined Index to a uniform standard throughout, and who have devoted ungrudging time and labour to this important work, and to the general revision of the Index.

In a work of so much magnitude and labour, it is quite inevitable that errors, both of omission and commission, as well as inconsistencies in plan and method, will to some extent have survived the careful processes of scrutiny and revision adopted. It is however hoped, with some confidence, that the Index now issued will on the whole be found adequately to meet the needs of the profession, and, as regards systematic arrangement and accuracy, to approximate to the high and classical standard, set and maintained by the compilers of previous combined Indexes.

THOMAS G. ACKLAND,

Honorary Editor of the Journal.

Chairman of the Library Committee.

September, 1907.

JOURNAL OF THE INSTITUTE OF ACTUARIES.

FIRST published in September 1850, by Mr. CHARLES JELlicOE and Mr. SAMUEL BROWN, as *The Assurance Magazine*. Successive numbers bearing this title were issued in January 1851, and thenceforward quarterly, up to July 1852 inclusive. Adopted by the Institute of Actuaries for the record of their Transactions in October 1852 (vol. iii), and issued from that date, to January 1866 (vol. xii) inclusive, as *The Assurance Magazine and Journal of the Institute of Actuaries*. From April 1866 to July 1867 (vol. xiii) inclusive, the numbers issued bore the title *Journal of the Institute of Actuaries* only. From October 1867 (vol. xiv) to October 1885 (vol. xxv), the combined title *Journal of the Institute of Actuaries and Assurance Magazine* was adopted. In January 1886 (vol. xxv), and in all subsequent issues, the title of *Journal of the Institute of Actuaries* was employed. (See *Journal*, vol. iii, p. 91; vol. xx, p. 118.)

Between September 1850 and October 1906, both inclusive, 226 numbered parts of the *Journal* have been issued, the second number having been published in January 1851, and successive numbers at quarterly intervals, with the following exceptions: There were no numbers published dated April 1881 and January 1883, and the issues of July and October 1885 were combined under one number (138). In July 1891, besides the usual quarterly number, a special part (162) was published "On the German Law of Insurance against Invalidity and Old Age", by T. E. Young. A special double number (205-6) was issued between January and April 1902, "On the Actuarial Aspects of recent legislation on the subject of Compensation to Workmen for Accidents" (Brown Prize Essay, 1900), by John Nicoll; and a special part (212) was published between April and July 1903, "On the Mortality Experience of the Imperial Forces during the War in South Africa (1899-1902)", by F. Schooling and E. A. Rusher. This last-named part has been reprinted for separate sale to Members and the public, and also that issued in October 1888 (No. 150), "On Friendly Societies" (Messenger Prize Essay, 1886), by G. F. Hardy.

A Combined Index to the First Ten Volumes was issued in 1864. A Combined Index to the First Twenty Volumes, compiled by Dr. T. B. SPRAGUE (Editor of the *Journal*), was published in 1883; and a Combined Index to Volumes XXI to XXX, compiled by Mr. G. H. RYAN (Editor of the *Journal*), was published in 1896.

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Dates of Appointment and Resignation	Names of Honorary Editors	Names of Sub-Editors	Reference in <i>Journal</i>
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1893	H. J. ROTHERY	E. R. STRAKER	xxx, 579; xxxi, 403.
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$$\left[\text{If } \frac{1+a_x}{1+a_{x+1}} > \frac{1+a'_x}{1+a'_{x+1}} > 1, \text{ then will } \frac{a_x}{v(1+a_x)} > \left(\frac{1}{1+a'_x} - \frac{1}{1+a_x} \right) \frac{1}{v-v'} \right]$$

xxv, 277. (*See also* T. B. Sprague, xxi, 98.)

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— v, 143. Comparative tables of rates of mortality and sickness among Friendly Societies (Finlaison, Neison, and Ratcliffe), and five theoretical tables, one of which represents the annual mortality of the total Male population of England.

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— xxiv, 68. Gotha Mortality Table, E_x , actual deaths, ${}_nV_x$, l_x , d_x , q_x , e_x , unadjusted and adjusted by two methods, at 3 per-cent.

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- Farren, E. J.**, i, 46. Comparison of π_x by Halley's Breslau Table of 1693 at 6 per-cent with Farr's Table of 1844 at 3 per-cent.
- v, 195. Average amounts of £100 at compound interest from 1 to 100 years at rates fluctuating between the limits of 0 and 6 per-cent per annum.
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- Foster, Dr. T. A.**, xxv, 251. Average weight of persons of various heights, and Nosological Tables.
- Frankland, F. W.**, xxiv, 211. Mean population and deaths in New Zealand during 1874, 1878, and 1881, aggregate for the three years, and values of m_x .
- Fraser, D. C.**, xxxiv, 501. Table showing the yield on Stock sold at the end of 15 years at a premium on the price of purchase.
- xxxviii, 415. Table showing the Reserves of the Model Office (King's) by various groupings and a comparison of each with the Reserve, by an exact Net Premium valuation. HM 3 per-cent.
- Fulford, F. W.**, xxxv, 211. Percentage of Policy-values by Sprague's Select Life Tables to HM values. Interest 3 and 4 per-cent.
- xxxv, 215, 219, 223. Comparison of surrender-values of Life policies obtained by various formulas.
- Galsworthy, E. H.**, iv, 88. Mortality of Master Mariners (Neison's Data). A_x and ϖ_x , at 3 per-cent.
- Grant, M. D.**, xl, 141. Mortality Tables for Ontario, 1901; also probabilities of life in the Healthy Districts of England, 1881-90, and in Scotland, 1891-1900.
- Gray, P.**, ii, 273. Carlisle 3 per-cent. $A_x, \log A_x, \log (1 - A_x)$.
- vi, 198. Orchard's Theoretical Table of Mortality. $l_x, d_x, e_x; A_x$, and ϖ_x at 3 per-cent; a_x at 3, 4, 5 and 6 per-cent.
- vii, 129. Carlisle Table adjusted by Gompertz's Method. $\log p_x, \log l_x, l_x, d_x, e_x$.
- x, 90. Commutation Tables (D_x, N_x, S_x, M_x , and R_x). Single male life. Government Annuitant Experience, 1860. Interest 4 per-cent.
- xi, 237. Annuities on two lives at 3 per-cent interest, deduced from adjustments of the Carlisle Table; with which the modifications are also compared.
- xii, 91. Table for the formation of logarithms and anti-logarithms to 12 places: $\log (1 + \cdot 001n), \log (1 + \cdot 001^2n), \log (1 + \cdot 001^3n)$.
- Gray, W. T.**, xx, 328. Comparative Reserves by the "Mixed" method of valuation, for various tables of mortality. Interest $\frac{1}{2}$ per-cent.
- xxiv, 256. Rates of mortality, exposed to risk, and deaths, 3 per-cent annuities and policy-values, by following tables, namely, $HM^{(0-4)}, HM^{(5)}, HM$, and tables obtained by working out the withdrawals and existing of the HM data on various assumptions, and combining the results with the HM actual experience.

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— xxv, 217. Indian Census Returns, 1881. Infantile mortality in various provinces. Migration statistics. Effect of famines on population. Distribution of males and females in decennial age groups, Madras. Comparison of native and European mortality in India. Birth and death rates in various provinces. Age distribution of male and female population of various provinces in quinary age groups, 1871, 1881. Mean duration of life at each 10th age for various provinces; males and females separately. Native Life Table for India, males and females, l_x , q_x , e_x . Ages 0, 5, 10, . . . 90.

— xxvii, 245. Friendly Societies. Table of Affiliated Orders in the United Kingdom, 1886. Aggregate Balance Sheet of 6,567 Societies. Experience of New Zealand Friendly Societies. Table of sickness rates in Danish Societies. Comparison of Essex Provident Society experience, 1876–80, with Neison's Rural Districts, 1836–40, and M.U. and A.O.F. Comparison of sickness and mortality rates in various Experiences. Effects of selection on sickness rates. Tables illustrating the financial effect of changes in the rates of sickness and mortality. Secession experience. Table showing the average deviations of deaths from the adjusted results, A.O.F. experience, 1871–5. Table showing the mean deviation of the observed sickness from the adjusted results, A.O.F. experience, 1871–5. M.U. and A.O.F. experiences—Monetary tables and values of sickness benefits.

— xxxi, 261. The Use of Scales of Premium reduced in anticipation of Future Bonuses. Reduction of Premiums by application of Bonus: Cash, Simple, Reversionary and Compound Reversionary Bonus. Abatements from whole-life policy-values to obtain reduced premium policy-values: Simple and Compound Reversionary Bonuses, H^M 4 and $4\frac{1}{2}$ per-cent. Difference between the 3 per-cent and 4 per-cent. H^M Policy-values (continuous).

— xxxii, 158. Preliminary tables for the temporary deductions to be made from the sums assured upon rated-up lives, in lieu of extra premium.

— xxxiii, 485. Mortality Experience of Assured Lives and Annuitants in France. Data, constants of graduation, expectation of life of assured lives and annuitants (unadjusted), as compared with the H^M and Government Annuity Experiences. Net annual premium at 3 per-cent interest compared with those by the H^M and 23 German Offices' Experience. Unadjusted Mortality Table, q_x , l_x , d_x , e_x , for assured lives, male and female, and annuitants, male and female. Comparison of actual with expected deaths according to the adjusted mortality tables. Comparison of mortality of annuitants and assured lives. Annuity values at 3 per-cent interest compared with other tables, for assured lives and annuitants.

— xxxiii, 494. Select net annual Premiums graduated by Makeham's formula, as compared with T. B. Sprague's $H^{(M)}$ Select Tables.

— xxxiv, 93. Tables for the computation of Compound Survivorship Annuity Values. ($\bar{a}_{y:z}^1$). H^M and Carlisle Mortality, 3 and 4 per-cent interest.

— xxxvii, 175–179. British Offices' Experience, 1893. Whole-Life Participating Assurances, Males, Select Mortality Tables: Net Annual Premiums, and Policy-values at 3 per-cent; compared with T. B. Sprague's $H^{(M)}$ Tables, and with H^M and $H^{M(6)}$ policy-values. Whole-Life Non-Participating Assurances, Males. Whole-Life Participating Assurances, females. Rates of Mortality, full Aggregate Tables and truncated Aggregate Tables. Comparison of q_x by different Mortality Tables.

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— iii, 366. Equitable Experience, "Table A." (1762-1829). $\log l_x$, p_x , a_x , A_x , ϖ_x , at 3 per-cent.

— iv, 383. Values of Annuities-certain for any number of years not exceeding 100, at the rates of interest $1\frac{1}{8}$, $1\frac{3}{8}$, $1\frac{5}{8}$, $1\frac{7}{8}$, $2\frac{1}{8}$, $2\frac{3}{8}$, $2\frac{5}{8}$, $2\frac{7}{8}$, per-cent.

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— xxxi, 81-84. Commutation Table and Value of Annuities and Single and Annual Premiums on the basis of the H^M Mortality Table with interest at $3\frac{3}{4}$ per-cent.

— xxxi, 115-146. Hearts of Oak Benefit Society. Sickness, Mortality, and Secessions experienced during the period 1884-91, embracing two years of the Influenza epidemic. Abstract of Accounts for each of the eight years 1884-91. Summary of Assets and Liabilities as per periodical valuations, 1884-91.

— xxxvi, 70. Table showing the effect of the rate of cessation when treated as a function of the rate of interest. Carlisle Table, 3 per-cent.

— xxxvi, 316-7. Specimens of Annual Premiums and Reserves. British Offices' Experience, 1893 (Male Whole-Life Participating Assurances) compared with H^M and H^{M(5)}. Interest 3 per-cent.

— xxxvii, 147. Comparison of full and truncated aggregate tables, British Offices' Experience, 1893 (Male Participating Assurances) and Institute Experience H^M and H^{M(5)}.

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- Higham, J. A.**, i, 180. Tables analyzing the Seventeen Offices' Experience as regards the effect of selection.
- i, 198. Select Lives. Seventeen Offices' Experience. "Mixed Mortality", p_x, e_x, a_x at 3, $3\frac{1}{2}$ per-cent; "Class Mortality", $p_{x+t}, e_{x+t}, a_{x+t}$, at 3 and $3\frac{1}{2}$ per-cent, for $[x]=25, 30, 35 \dots 75$.
- vii, 116. Sickness allowance to males engaged in heavy labour (from A. G. Finlaison's Data). D, N, and value of allowance of 1 a week in sickness, for the whole of life, at $3\frac{1}{4}$ per-cent.
- xxiii, 335. Graduation of H^M data by three successive applications of his method, d_x, l_x, e_x .
- xxv, 15. Graduation, by his method, of Government Annuitants' Table, Females, 4 years after purchase, 1882. Graduation of H^M Table by methods of Higham and Woolhouse, showing Woolhouse's final adjustments.
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- v, 324. Tables showing the mortality experience by the Gotha Life Office during the years 1829-53, compared with other tables of mortality.
- Hume, A. S. and Stott, W.**, xxxiv, 397-412. Tables of values of whole-term policies, with limited number of premiums. H^M 3 per-cent. Entry ages 15 to 60. All policy durations. Premiums limited to 10, 15, 20, 25, or 30 annual payments.
- xxxvi, 393-8. Annual Premiums for Endowment Assurances on two joint lives of equal age. H^M 3 per-cent. Text-Book graduation. Ages 20, 20 to 60, 60. Term of assurance, 5 to 50 years. Ages at maturity not exceeding 70, 70. Also table of uniform seniority.
- xxxix, 373-5. Factors for contingent assurances. H^M Text-Book graduation, and Carlisle Table, Makeham graduation. Interest 3 per-cent.
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- Humphreys, N. A.**, xxvii, 486. The Recent Decline in the English Death Rate and its effect upon the Duration of Life. Table of annual rates of mortality per thousand of males in England and Wales during each quinquennium of the years 1841-80, at various groups of ages. Similar table for females. Table showing mean annual mortality of males and females in England and Wales in the 17 years, 1838-54, and in the 5 years, 1876-80. Various English Life Tables based on these data.
- Hunter, A.**, xxxvi, 57. The effect of using the Lapse element in calculating premiums and reserves. Life and Commutation Tables. Net Premiums and Reserves. H^M Mortality and Lapse Rates. Interest 3 per-cent.
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— iv, 210-214. Eagle Experience. 100 q_x , ℓ_x , males and females; 100 q_x , l_x , d_x , ℓ_x , combined males and females, unadjusted; 100 q_x , l_x , d_x , ℓ_x , a_x , and ϖ_x , at 4 per-cent, ditto adjusted.

— vii, 134. Mortality among persons residing in foreign climates, or engaged in pursuits attended with extra risks (data collected by the Institute); 100 q_x , for lives resident in America, Asia, and Australia; also for marine and military risks.

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— xx, 233. Analyzed Mortality. $a_{[x]+n}$ at 3, $3\frac{1}{2}$, and 4 per-cent; also ${}_nV_x$ at 3 per-cent, for $x=20, 25, 30 \dots 65$, $n=5, 10, 15 \dots 50$.

— xx, 268. Comparison of Reserves by Combined H^M and $H^{M(5)}$ Tables with Reserves by various other Tables, at 3, $3\frac{1}{2}$, and 4 per-cent.

— xxiv, 186. Data from which Carlisle Table was formed; in original groups and distributed among ages; values of m_x .

— xxvi, 276. On the Numerical Calculation of the values of Complex Benefits. Table of values of $\log \mu$ and of μ , H^M Table, by formula $12 l\mu = 7(d_{-1} + d) - (d_{-2} + d_{+1})$.

— xxx, 291. On Family Annuities. Tables of bachelors, husbands, and widowers from the 1881 census, England and Wales. Table illustrating the orphanhood of children. Table of values of family annuities. Commutation tables for family annuities.

— xxxiii, 264-6. The Rates of Mortality among Female Nominees of the General Annuity Trust Fund. Data, Mortality Table, l_x , d_x , p_x , q_x , and ℓ_x . Annuity Values at $2\frac{1}{2}$ per-cent interest and comparison with Government Experience.

— xxxvii, 476-91. Reserves by H^M and $H^{M(5)}$, O^M , $O^{M(5)}$, and combined O^M and $O^{M(5)}$ Mortality Tables, at $2\frac{1}{2}$, $2\frac{3}{4}$, 3, $3\frac{1}{2}$, and 4 per-cent interest, and a comparison of each with the Reserve by the O^M Table at 3 per-cent interest; also reserves by the $O^{M(1)}$ Select Table at 3 per-cent interest, compared with the preceding, xl, 12.

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— xi, 59. Annuity-values from age 60. Seventeen Offices' Experience, 3 per-cent interest.

— xi, 235. Table giving the half-yearly and quarterly premiums corresponding to yearly premiums, 1.00, 1.05, 1.10 \dots 10.00, 3 per-cent.

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— xl, 369. Continuous Temporary Annuities. ($\bar{a}_{M-\frac{n}{n+1}:n}$). O^M $2\frac{3}{4}$ per-cent.

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- Lewis, J. N., Manly, H. W. and Thomas, E. C. See Manly, H. W., Thomas, E. C. and Lewis, J. N.
- Lidstone, G. J., xxx, 212. On an application of the Graphic Method to obtain a Graduated Mortality Table from a Limited experience, by means of a comparison with a Standard Table. Values of p_x , q_x , for the Marine and General experience, in respect of mariners' lives.
- xxxii, 96. Table of specimen Bonus additions according to the Premium System, the HM Loading System, and the Select Loading System; modifications of "Sprague's Method" for whole-life assurances. Ditto for endowment assurances, xxxii, 100.
- xxxiii, 356. Premiums for endowment assurances on two joint lives of equal ages. HM 4 per-cent.
- xxxiv, 61. Tables illustrative of several methods of valuation of Endowment Assurances in groups; of $-\Delta_x a_{x:n}$, HM 3 per-cent; of $Z_M = \text{Sum Assured} \times (1.09561)^{M-55}$, and of Continuous Temporary Annuities, HM 3 per-cent.
- xxxiv, 513. Table showing summary of valuation of endowment assurances in groups.
- xxxviii, 34 (*after*). Tables of $Z_M = \text{Sum Assured} \times (1.08)^{M-55}$ and of $Z_M = \text{Sum Assured} \times (1.093956)^{M-55}$, and O^M and $O^{M(5)}$ mortality respectively.
- xxxviii, 422. Table showing the effect of the various methods of grouping for valuation as regards:—
 (1) The average assumed age at entry.
 (2) The average assumed duration.
 (3) The average assumed valuation age.
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- xxx, 120. Remarks on Consumption in Relation to Life Assurance. Table of causes of death of members of the Mutual Life Office who had a consumptive family history, and of the comparative ratio of the deaths from these causes.
- Macaulay, T. B., xxiii, 62. Weight of male adults of various heights, ages, and occupations.
- McCay, C. F., xxii, 24. Graduation of HMF observations and of HMF after 10th year, with reference to the weight of the observations.
- McDonald, J., xxxii, 448-457. Annual and single endowment assurance premiums. Values of $\log D_{xx}$, $\log N_{xx}$, and a_{xx} . HM $2\frac{1}{2}$ per-cent.
- and Burn, J. See Burn, J. and McDonald, J.
- Macfadyen, J. R., xvii, 405. Table of a_x and $\log a_x$. Finlaison's (1860) Government Annuitants' Experience (males), combined observations. Interest 5 per-cent.
- xvii, 406. Surrender-values, when profit appears chiefly under the one aspect of interest. Also with modifications by Jellicoe's Formula.
- McGowan, J., xxxvii, 24-26. Rates of contribution, or percentage deductions from salary, for Pension Funds. HM Mortality, 3, $3\frac{1}{2}$, and 4 per-cent.
- xxxvii, 33. Rates of discontinuance in a pension fund.
- Mackenzie, A. G., xxix, 185. On the Practice and Powers of Assurance Companies in regard to the Investment of their Life Assurance Funds. Average rate of interest earned by Life Offices on their funds as ascertained by averages in the Board of Trade Returns for 1872, 1883-1890. Table showing for all offices, and for 21 mutual offices, the classes of investments with the proportion of the funds invested in each class, for the years 1872, 1882, 1890.
- McKenzie, D. J. McG., xxiii, 183. Logarithms of constant factors for transforming yearly annuities-certain to annuities payable n times a year; and fractional rates of interest corresponding to yearly rates.

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— xxiii, 417. Momently rates of interest with factors for transforming yearly annuities-certain into momently annuities.

— xxiv, 251. Logarithms and anti-logarithms true to 10 places.

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— ix, 365. Carlisle Table, adjusted. l_x , d_x , and \bar{e}_x .

— xii, 324. Carlisle Table. Mean duration of life re-adjusted by means of a modification of Gompertz's formula.

— xiii, 344. Adjusted Mortality Table, Finlaison's Males of Friendly Societies. l_x , d_x , q_x , e_x .

— xiv, 161. Extra Risk premiums for different classes of assurance.

— xv, 437. Table for determining the amounts, &c., of continuous annuities-certain; $\log \frac{e^x - 1}{x}$ for values of x , .00, .01, .02 . . . 10.40.

— xvi, 413. Sickness and Invalidism (A. G. Finlaison's Data). Tables showing the numbers of sick and healthy among l_x persons of age x ; also the number invalided between ages x and $x+1$, the number of recoveries, &c.

— xvii, 312. Values of the integral of Gompertz's function, $\frac{1}{\log q} \cdot \frac{1}{10^{-10z} e^{-nz} c} \int_z^x 10^{-10z} e^{-nz} \cdot c \cdot dz$, for values of z from 1.0 to 1.9, and n from 1.0 to 1.4, proceeding by differences of .1.

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— xiv, 293. Comparative Reserves by various Mortality Tables and methods of valuation, at different rates of interest.

— xxiii, 233. Scale of office premiums to provide a specified bonus; HM 4 per-cent premiums loaded for expenses and bonus.

— xxvi, 208. Extract from a Report by L. G. Fouse on Standard Rates for Assessment Companies. Table of rates. Meech's tables of mortality and lapse. Table showing the working of an "Assessment" Fund under specified conditions.

— xxvii, 362. Formulas and Tables for applying Profits to converting Whole-Life Policies into Endowment Assurances, and to making Endowment Assurances payable at an earlier age. Table giving the multiples of .01 ($1 + a_x$), for ages 15 to 65, HM 3½ per-cent. Table giving the values of $t_{-z-1} a_z$ and $\frac{t_{-z-1} a_z}{A_z}$ for $z=15$ to 80, HM 3½ per-cent, with the differences of these values divided by 12.

— xxx, 97. An attempt to measure the Extra Risk arising from a Consumptive Family History, when the Life proposed for Assurance is physically sound and healthy. Tables of observation, giving entered, exposed to risk, died, and expected deaths by HM Table, of persons with consumptive family history in the experience of the Mutual Life Assurance Society. Mortality tables derived from these. Annuity tables derived from these, 3½ per-cent. Corresponding table of endowment assurance premiums, 3½ per-cent.

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- xxxviii, 137. Mortality and Monetary Tables, Staff Pension Fund for Widows and Orphans. Hypothetical Experience, 4 and 3 per-cent.
- and **Thomas (E.C.)**, xxxvi, 260–276. Staff Pension Fund Hypothetical Experience. Rates of Mortality, Withdrawal and Retirement. Commutation Columns, Pension age 65, interest 4 per-cent. Special mortality table for finding annuity-values on invalid lives. Tables for valuing return of contribution with compound interest at 4 per-cent on death or early retirement, and for finding the value of a pension of 1 per annum for each year of service on early retirement. Average salaries. Valuation multipliers.
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- Meikle, J.**, xi, 48. Table for facilitating the calculation of survivorship annuities during one life, provided another die in n years; N_{xz}^1 , N_{xy}^1 , Carlisle 4 per-cent.
- xxiii, 385. Hypothetical Mortality Tables giving equal policy-values at 3 per-cent interest.
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- xxxvi, 28. Comparison of Fund arising from the accumulation of premiums, with the corresponding reserve values. HM 3 and $3\frac{1}{2}$ per-cent. Full profit and discounted-bonus policies.
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- xxxvi, 479. Table showing the compensations allowed by the laws of various countries to workers injured by accidents, and to their dependants in case of death resulting therefrom.
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- — and **Yule, G. U.** See **Beeton, Miss M., Yule, G. U. and Pearson, Karl.**
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- xxi, 257. Births, deaths, and census returns in New South Wales, 1860 to 1875, males and females; mortality table, values of annuities, assurances and commutation columns based thereon.
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— xxxii, 29. Tables for valuations for solvency in Life Assurance Companies.

— xxxvi, 357, 359, 360. Decennial rates of increase in population of England and Wales since 1801. Population of Europe. Birth and death rates in the United Kingdom and in other European States in 1874 and in 1899; showing the difference in the natural increases for the respective years.

— xxxviii, 82–3. Comparison of bases of valuation in use by 52 British Offices, 1870–1900.

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— xxxiv, 368. Various tables giving rates of mortality, &c., applicable to the assessment of military and naval risks, with a table of premiums.

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3 per-cent; $\pi = (1-v) \frac{\Lambda}{1-\Lambda}$.

— xviii, 373. Indian military lives and civil lives (S. Brown's data). a_x and π_x , at 3 per-cent.

— xxii, 144. Endowment assurance annual and single premiums based on H^M 3 per-cent Table. $P_{x:n}$ and $\Lambda_{x:n}$ for $x=15$ to 60 and $n=5$ to 60, but $x+n$ not greater than 75.

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— xxi, 309. On the graduation of mortality tables. Woolhouse's graduation of HM^F observations; Δq_x and comparison of actual and expected deaths. Graduation of Carlisle Table by Makelham's method; deviation of l_x by ordinary, aggregate, and combined methods. Graduation of HM^F data by different methods; q_x for ages 10 to 30.

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— x, 198. Seventeen Offices' Table (town males). Numbers exposed to risk, actual and expected deaths, by English Life Table (No. 2).

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— xiii, 308. Table showing the addition to the value of annuities when paid half-yearly. Interest 3, 4, and 5 per-cent. Seventeen Offices' Experience.

— xiv, 432. Life Annuities, Immediate and Reversionary. (1) Policy and redemption money, when a life annuity of 1 is purchased, allowing for insurance at an average rate, and returning the purchaser 5 and 6 per-cent respectively on his outlay. Policy = $\frac{1}{\varpi + d}$,

redemption money = $\frac{1-d}{\varpi + d}$. (2) Values of Reversionary Annuity, as found by Jellicoe's formula, $\frac{1}{P + d_5} - a_{xy3\frac{1}{2}}$, and by Sprague's

$$\frac{1}{P + d_6} - \frac{1}{2} - \left(1 - \frac{d_6}{2}\right)a_{xy6}, \text{ and } \frac{1}{P + d_5} - \frac{1}{2} - a_{xy6}\left(\frac{P + d_6}{P + d_5} - \frac{d_6}{2}\right);$$

(3) Annuity which 1 will purchase, and its redemption money, by the same three formulas.

— xv, 328. On the rate of mortality among assured lives as influenced by the duration of the assurance; numbers at risk; actual and computed deaths; probabilities of dying in a year; percentage of actual to computed deaths. Peerage Males, Seventeen Offices', and New Experiences.

— xviii, 313. Coefficients in Lubbock's formula for summation: $\frac{n^2-1}{12n}$, $\frac{n^2-1}{24n}$, $\frac{(n^2-1)(19n^2-1)}{720n^3}$, $\frac{(n^2-1)(9n^2-1)}{480n^3}$, $\frac{(n^2-1)(863n^4-145n^2+2)}{60480n^5}$, and $\frac{(n^2-1)(275n^4-61n^2+2)}{24192n^5}$, for values of n from 2 to 11; and their logarithms.

— xxi, 77. On policy-values as affected by an increased mortality. Rates of mortality by Northampton, Carlisle, Davies' Equitable, and H^M Tables. Tables of ratios of values of annuities-due, by Carlisle, Northampton, and Institute Tables, 3 per-cent, &c., to trace effect of increased mortality on policy-values. Values of $(1+a_x)$ and q_x by various hypothetical tables giving equal policy-values. Comparison of policy-values on various bases.

— xxi, 229. On the construction of Select Mortality Tables. Mortality during five years following medical selection, l_x , d_x , q_x , H^M data. Mortality in first and second half-years following medical selection, as affected by duration of fatal illness. Annuity-values and commutation columns for five years following medical selection at 3 and 4 per-cent interest for quinary ages— HM data.

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- xxi, 406. Marriage and mortality observations of British Peerage families. Various probabilities of bachelors marrying and of marriages becoming fruitful. Comparison of mortality among bachelors and married men. Combined marriage and mortality table showing numbers living as bachelors and married men; decrements caused by bachelors dying, bachelors marrying, married men dying; number of bachelors marrying whose marriages are fruitful. Table of values of certain benefits depending upon the combined contingencies of marriage and mortality; table of commutation columns for same benefits; interest 3 per-cent.
- xxii, 77. Marriage statistics of widowers belonging to British Peerage families; years of life observed, died, married, central marriage rate for each year following widowhood, and ultimate central marriage rate.
- xxii, 117. Issue statistics (Scotland); number of unfruitful marriages at beginning of each year following marriage, number becoming fruitful, number dissolved by death, and probability of issue of marriage hitherto unfruitful.
- xxii, 269. Policy-values for durations, 1 to 10, by H^M Table, combined H^M and $H^{M(5)}$, combined Select and $H^{M(5)}$. Interest 4 per-cent.
- xxii, 352. Rates of marriage among widows and spinsters. Population of Scotland, 1870-1872.
- xxii, 359. Probability that a marriage entered into by a man above 40 will be fruitful. British Peerage families. Number of marriages observed and number fruitful and unfruitful; ages 40 to 79. Bachelors and widowers separately.
- xxii, 391. On Select Mortality Tables. Select Mortality tables H^M data, q , l , d , D , H , M , a , for ages $[x]$, $[x] + 1 \dots [x] + 4$ combined with $H^{M(5)}$ values; $\pi_{[x]}$ and $A_{[x]}$ on same basis. Ages from $[15]$ to $[75]$. Interest 4 per-cent. Number of damaged lives, $(ul)_x$, contained in a body of mixed lives after various periods from medical selection; number of damaged lives dying each year, $(uq)_x$, $(uD)_x$, $(uH)_x$, $(uM)_x$, $(ua)_x$, $(uA)_x$, H^M data. Interest 4 per-cent. Age of H^M life equivalent to select life after 0, 1, 2, 3, 4, 5 or more years from medical selection. Values of policies at 4 per-cent on mixed and healthy lives by various combinations of H^M , $H^{M(5)}$, and Select Tables; and also on assumption that first year's premium is absorbed by current risk and expenses. Effect on mortality of withdrawal of healthy lives, ages 35 to 40. H^M data. Scale of office premiums for short term assurances based on select tables. Single and annual net premiums for short term assurances on select lives, on various assumptions as to withdrawal of healthy lives; half premiums first 5 years if all healthy lives withdraw; first year's risk on whole life assurances allowing for selection for and against office.
- xxiii, 221. Issue Policies in force, 1875 to 1880, sums assured, premiums received and average premiums.
- xxv, 54. Mean force of Navy at various stations, and percentages dying and invalided in 1878. Decennial age groups.
- xxv, 160. Probability of a marriage becoming fruitful, British Peerage families. Number of marriages observed, number becoming fruitful, number dissolved by death of husband, by death of wife, by divorce, number remaining unfruitful, for ages of husband at marriage in decennial groups and for each year following marriage. Observations grouped according to wife's age at marriage. Comparison with observations of Dr. Duncan and Mr. Ansell.
- xxv, 437. Mortality among Europeans in tropical Africa. Observations of 262.5 years of life.
- xxvi, 77. The graphic method of adjusting mortality tables, with an application to A. J. Finlaison's observations on the mortality of the Female Government Annuitants, four years and upwards after purchase. Comparison of adjusted values of q_x , ages 27-70, obtained by Higham, Finlaison, and Sprague. Comparisons of actual with expected deaths according to the several graduations. Complete table of adjusted values of q_x according to Sprague's graduation.

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- xxvi, 391. Issue Policies in force. 1881 to 1885, sums assured, premiums received, and average premiums.
- xxvi, 471. The Pole Star Life Insurance Company of Stockholm. Discontinuance table. Tables of the number of deaths in various insurance periods.
- xxvii, 195. On the Probability that a Marriage entered into by a man of any age will be fruitful. Tables showing the marriages of the peers of 1870, and of their sons, brothers and uncles. Tables of marriages of peers and their sons, &c., distinguishing the marriages of men who married as peer or heir apparent, and who did not marry as peer or heir apparent. Tables of the adjusted probabilities that in these cases the marriage will be childless.
- xxviii, 350. On the Premiums for Assurances against issue to Widowers, Bachelors and Married Men. Table showing ultimate re-marriage rate of widowers, comparison of percentage of childless marriages in Day's and Sprague's results. Single premiums as shown by Day's and Sprague's results, for an endowment at the second marriage of a widower. Table of central death and issue rates. Central marriage rates of chronic widowers. Combined marriage and mortality table for chronic widowers, ages 45 and upwards. Central marriage rates and combined marriage and mortality table for recent widowers. Commutation Tables, 3 per-cent, for chronic and for recent widowers. Tables of marriage endowments, and of assurances depending on marriage and birth of issue for chronic widowers, for recent widowers, for commencing widowers, and for bachelors. Mortality table for married men as deduced from peerage experience. Mortality table for females as deduced by Bailey and Day from peerage experience.
- xxix, 59. Further Remarks on Woolhouse's Method of Graduation, with a comparison of the adjustments of the $H^{M(5)}$ Table by Woolhouse's, and the graphic methods respectively. Table showing the adjusted probabilities of dying in a year according to the graphic method. Similar table for Woolhouse's method.
- xxix, 232. Final Remarks on Woolhouse's Method of Graduation, and a table showing its application to the Text-Book Table.
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- xxxi, 227. Comparison of the actual and expected deaths among the healthy female lives of the Scottish Equitable Life Assurance Society.
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- xxvii, 81. On Risk Premiums for Survivorship Assurances. Tables for the calculation of these premiums at 4 per-cent, using Sprague's Select Mortality Tables (modified) for the insured life, and the Government Female Annuitants Analysed Table for the counter life. Comparison of above premiums for specimen ages, with the Carlisle and H^M premiums. Tables showing the addition to these single and annual premiums to cover the risk of the insured life dying within one year after the counter life.
- xxviii, 257. On Bonuses on Endowment Assurance Policies. Table of bonuses arising from surplus interest and loading.
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$$\left[\text{If } \frac{1+a_x}{1+a_{x+1}} > \frac{1+a'_x}{1+a'_{x+1}} > 1, \right.$$

$$\text{then will } \frac{a_x}{x(1+a_x)} > \left(\frac{1}{1+a'_x} - \frac{1}{1+a_x} \right) \frac{1}{x-x'} \Big], \text{ xxv, 277.}$$
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